DOCUMENT RESUME

ED 025 821 CG 003 542

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Contingency Management in an Introductory Psychology Course for One Thousand Students.

American Psychological Association, Washington, D.C.
Pub Date 30 Aug 68
Note-17p.; Paper presented at the American Psychological Association Convention, San Francisco, California, August 30 through September 3, 1968.
EDRS Price MF-$0.25 HC-$0.95
Descriptors-College Curriculum, *Curriculum Planning, Demonstration Programs, Educational Finance, *Higher Education, Instruction, Scheduling, *Student Teacher Ratio, *Student Teacher Relationship, Teaching Load, *Underachievers

An experimental college course was designed to develop solutions to form major problems in higher education: student underachievement, large student/faculty ratios, high cost of education, and the complaint that liberal education is difficult to achieve and irrelevant to the world of affairs. To improve student achievement, daily reading assignments and quizzes were instituted; responses to be learned were clearly specified; opportunity was given for make-up work; 100% mastery was required; error analysis and immediate feedback were supplied; and laboratory procedure quizzes were given. A strict absence policy prevailed. In dealing with student-faculty ratios, small discussion groups used student leadership and grading, better students served as teaching apprentices, paid student assistants supervised labs, seminars, quizzes, and lecture sections. Faculty members were involved primarily in lectures and planning. Efficient classroom scheduling, in addition to the above measures, reduced costs. A course in behavioral science is amenable to being made highly relevant to the world of affairs. (BP)

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Contingency Management In An Introductory Psychology Course For One Thousand Students

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This is a description of an experimental college course designed to develop and demonstrate solutions to four major problems in higher education. These problems are (1) student underachievement, (2) large student/faculty ratios, (3) the high cost of education, and (4) the common complaint that a liberal education is difficult to achieve and irrelevant to the world of affairs.

STUDENT ACHIEVEMENT

In a representative institution of higher education, 10 percent of the students are customarily on academic probation; many are eventually dismissed from school. This highlights the problem of student underachievement plaguing higher education. The customary failure of students to achieve their potential is widespread.

In spite of this state of affairs, it may be that all students meeting the normal entrance requirements of a college are capable of doing "A" level work at that college. Furthermore, it may be possible to design an educational system in which most students will attain this level of accomplishment.

Daily Reading Assignments and Quizzes

While some students work hard and earn the grade of "A" in their courses, others work very little and earn much poorer grades. Nonetheless, grades

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may be effective reinforcers for nearly all college students. The problem is that the schedule of reinforcement is too intermittent to maintain the behavior of many students with deficient histories. Students who appear unmotivated may work industriously if the proper schedule of reinforcement were used. Without the proper training history laboratory animals, required to make a large number of responses for each reinforcement, may respond very poorly. However, if the reinforcements are programmed more frequently, they may respond well.

In the introductory psychology course at Western Michigan University, the usual infrequent hour exams over large reading assignments were eliminated. In their place there are brief daily quizzes over one-hour daily reading assignments. This schedule seems to maintain more reading behavior than the usual hour exams. In addition, the students avoid the tendency to wait until the day before the hour exam to try to cram a large amount of material. Cramming on only an hour's reading assignment is essentially not cramming. When first exposed to daily quizzes, students may object; however they soon come to prefer daily quizzes to hour exams (see Figure 1). -

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Insert Fig. 1 about here

Clear Specification of the Responses to be Learned

In order to facilitate high students achievement, an attempt is made to specify as clearly as possible what will constitute mastery of the reading assignments. In the case of the programmed text material there is little ambiguity; however with the non-programmed material, there is considerable room for judgment. For these latter materials we provide a set of reading objectives with each assignment. They indicate what the student should

master.

Similarly, it may be that one of the reasons students have difficulty writing good laboratory reports is that it is not clear what is required. In order to eliminate some of this ambiguity, a detailed style manual and a sample laboratory report are provided.

Opportunities for Make-up Work

The regular daily quiz consists of two brief construction-type questions. If the student misses one or more of these questions, he has the opportunity to attend one of several make-up quizzes over that reading assignment. The first make-up quiz is given the evening of the regular quiz and follows a 40 minute remedial lecture over the day's reading assignment. If the student does not answer all six questions correctly or does not attend the make-up quiz that evening, several other opportunities for make-up quizzes are given during the remainder of the week and weekend. No special remedial work is provided for these remaining make-up quizzes.

In order to provide the students with ample opportunity to acquire laboratory report writing skills, they are allowed to rewrite their reports as many times as needed until an "A" level report has been prepared.

To facilitate the completion of laboratory experiments, opportunities for extra laboratory sessions are provided on Friday and Saturday.

100% Mastery Required

If the student does not pass, with 100% accuracy, one of the quizzes associated with each reading assignment, he must either drop the course or receive an "F" for the entire course depending upon the point in the term. This is known as the "Doom's Day Contingency". The assignments are sufficiently clear and reasonable and the opportunities to take the quizzes sufficiently

frequent that it is unnecessary for any conscientious student to come into contact with the Doom's Day Contingency, and few students do (see Figure 2).

Insert Fig. 2 about here

Even though an extremely aversive consequence is potentially available, it is so easy to avoid this consequence that the overall situation need not be particularly aversive as the data seem to show (see Figure 3).

Insert Fig. 3 about here

When these data were obtained, most of the make-up quizzes were given on Fridays and Saturdays which was the main reason for objection at that point. Since that time we have interspersed the quizzes throughout the week.

The laboratory was divided into four experiments to be completed in a total of 28 50-minute class periods. Because of the large number of students in each laboratory section, the manual apparatus, unattenuated test chamber, and various other factors, it was not clear whether it would be reasonable to expect the students to actually complete these experiments in the amount of time provided. They were informed that they were to perform the four experiments and write four laboratory reports for the semester; however they were not explicitly informed of the consequences of failure to do this. The laboratory met twice a week for the entire term. During the first terms this procedure was used, very few students completed all four experiments. The average number of experiments completed was between one and two. We prorated the students grade on the experiments they had not completed on the basis of the grade for the laboratory reports they had turned in. We

felt this was entirely unsatisfactory and decided to adopt a more courageous procedure.

Several changes were put into effect simultaneously. Possibly the most important is the requirement that in order for the student to receive any credit for a laboratory experiment, he must complete the experiment and turn in an 'A' level write-up of that experiment. Before the experiment can be considered complete, the animal's behavior has to be demonstrated to the teaching apprentice. In addition, Friday and Saturday are available for make-up laboratory work each week. The laboratory was also changed from two days a week for 15 weeks to four days a week for 7½ weeks for either the first or second half of the term. The result of all this has been that, out of more than 1,000 students, fewer than 12 failed to complete all four experiments and none failed to complete at least three experiments. Of those that failed to complete all four experiments, several were students for whom one or more rats died during the term.

Error Analysis

As anyone who has used test questions knows, an alarmingly high percentage of the questions are ambiguous, or otherwise poor. An error analysis is made of the quiz questions and on the basis of the error analyses, all of the questions are corrected and improved. Where there is a high level of error yet the question appears satisfactory, the reading material may be inadequate. An attempt is made to compensate for this in the make-up lectures and the reading objectives by emphasizing the especially difficult parts.

Immediate Feedback

Students are given immediate feedback on performance on the quizzes in that, as soon as the quiz papers are collected, the correct answers are

read; and if the students have any questions, they may ask the individual giving the quiz. In addition all of the student's scores are posted daily and cumulated weekly along with a grade distribution; so that, each week, the student knows exactly where he stands in terms of a letter grade for the course.

Procedure Quiz

No matter how clear the objectives and instructions are, the student must read them before they can be effective. We have observed that students tend to come to the laboratory unprepared. In order to reduce this, the students are given quizzes over the laboratory procedure sheets prior to each experiment. In addition, a video tape is shown demonstrating proper techniques for each experiment.

Students are also given quizzes over the laboratory style manual and the general course procedures. In addition they are quizzed over the special material they are to analyze in the discussion sections; this reduces the likelihood that a student's discussion will be hampered by his not having read all of the material. At this time of the writing, 100% mastery was not required on these materials.

Absence Policy

During the first year that we taught this course, the correlation between unexcused absences from class and grades in the course showed a tendency for students who had less than four unexcused absences to have final grades of A or B and for students who had more than four unexcused absences to have C's or lower. Though there are many possible interpretations of this correlation, it is the case that, the more absences the student has, the fewer the number of points he can earn, and therefore the lower the grade

he is likely to earn. A student might gradually slip from one grade to the next through repeated absences. No single absence is very important, but the cumulative deficit can be considerable. In order to prevent this, we allow a maximum of four unexcused absences. The student receives no credit for the day if an unexcused absence occurs; and if he has more than four unexcused absences, he receives an "F" for the entire course. This has virtually eliminated excessive unexcused absences. Only absences which can be documented as legitimate are actually excused.

What has been the level of achievement attained as a result of these various procedures? The students work about 12 hours per week for three hours of credit; 80% to 90% earn a final grade of "A" and less than 2% receive an "F". This is the case even though high academic requirements are imposed.

STUDENT/FACULTY RATIO

A widely recognized problem in higher education is the rapidly increasing number of students for each faculty member (student/faculty ratio). A common method of dealing with this is the use of large lecture sections, as the primary in-class teaching technique, combined with the re-definition of educational goals in terms amenable to multiple-choice, machine-scored, objective examinations. An alternative solution is needed. Laboratory experiences and small group discussions are valuable teaching techniques: oral and written verbal expression, creative behavior, and content mastery assessable only by essay examinations ought not be neglected.

One alternative solution is based on the evaluation of student performance by the students themselves. The work of students in small discussion groups and laboratories, laboratory report writing, and essay examination performance is graded by fellow students. In some instances, the grading

is done by peers; in other instances, the grading is done by more advanced students. Quality control is maintained by a sampling system involving other advanced students, teaching assistants, and faculty.

Peer Grading

One of the purposes of a course such as this is to develop verbal and oral fluency concerning the course subject matter. It is important that the students have an opportunity to emit verbal responses and for those responses to be reinforced. However, even in relatively small classes, there is little opportunity for all but the most locquacious of students to do this. In a 50 minute discussion class of 25 students, each student has an average of two minutes recitation time. Of course, even non-directive instructors utilize a large amount of this time and the rest is taken up by a small number of highly verbal students. Most students hardly recite at all.

Four-man student-led discussion groups were developed to deal with this problem. Students fill in detailed grading sheets each day evaluating the other three students in their discussion groups. There are obviously many difficulties with this. One problem is that of collusion; all of the students may agree to give each other good grades. We have attempted to reduce this by rotating the students through the various discussion groups each day. Each discussion group sits at a separate table which contains a microphone. A student teaching apprentice listens to the various tables during the discussion. Although he only listens to one table at a time, the students never know which table it is. If the students' evaluation of the speakers varies considerably from that of the apprentice, they receive a zero for the day's seminar.

Another major problem with peer grading is that of whether or not the students are able to accurately grade each other even if they are being conscientious. It is hoped that the discussion text is programmed adequately enough that the four students can come to a consensus during the discussion about the correctness of the talks which will be reasonably close to a correct response as defined by the instructor.

Teaching Apprentice

Each term, 52 of the best students in the introductory course are given the opportunity to act as teaching apprentices in the course during the subsequent term. This requires 16 hours of work each week for which the student receives four hours of academic credit. Every effort is made to ensure that the experience justifies the academic credit received. Each teaching apprentice is responsible for a discussion/laboratory section of 28 students which meets four times per week. In addition, he helps monitor the weekly lecture sections. The teaching apprentice conducts the laboratory sessions and helps students who are having difficulty with their experiments. He also edits and grades all of the laboratory reports. He monitors the discussions, administers and grades the daily reading quizzes, does the bookkeeping for each section, and supervises the make-up laboratories and make-up quizzes.

After one term as a teaching apprentice, 13 teaching apprentices serve as advanced teaching apprentices the next term. The advanced teaching apprentice monitors the performance of the teaching apprentices in the discussion/laboratory sections. He has a rating form which he uses to grade the teaching apprentice. These grades are posted daily and cumulated weekly. The advanced teaching apprentice grades on the basis of classroom performance, reliability of performing clerical work, accuracy of seminar monitoring, quiz grading, and laboratory report grading. In addition, the advanced

teaching apprentice helps with more advanced administrative aspects of the course.

Assistants

Four paid assistants each work 20 hours a week on the course. Two are graduate and two are undergraduate assistants. One assistant is primarily responsible for supervising the laboratory sections, another the seminar sections, a third the reading quizzes and lecture sections, a fourth acts as a general administrative assistant. They are also responsible for evaluating the performance of the advanced teaching apprentices. Enough typing and other clerical activities are involved to require the services of a full-time secretary.

Faculty

Three faculty members are involved part-time with this course. One is primarily responsible for the seminars, one for the laboratories, and one for the lecture and reading assignments and overall management of the course. In addition, several faculty members serve as guest lecturers once each term. When the course was first being established, a large amount of time was required of the faculty; however now the combined efforts are probably the equivalent of less than one-half time faculty member. At this point the course can essentially run without the involvement of the faculty except for lectures. Faculty are now chiefly concerned with maintaining and improving the standards of the course and developing new and better ways of administering the course and teaching the material.

We have been primarily emphasizing the solutions to problems of large student/faculty ratios in terms of the types of educational activities which are normally available only to students in small classes. There is another

dimension to this problem which should also be considered. It is usually felt that as the student/faculty ratio increases, the faculty are less aware of the needs, interests, and problems of the individual student. We have made systematic attempts to deal with this problem by obtaining elaborate student evaluations of each reading assignment, each laboratory experiment, each discussion meeting, and each lecture, as well as the overall course. On the basis of the student's opinions of the interest, value, clarity, etc. of the many units of the course, these units have been drastically modified and in many instances eliminated. Face-to-face interviews with a small sample of individual students are also conducted by the faculty and assistants. These techniques combined with the results of error analyses of the individual quiz questions give the students a degree of control over the course which is much greater than is customary. We are able to be more responsive to the wants and needs of the students in this large course than is usually the case with smaller courses using more traditional techniques.

Results

To what extent then have these techniques been successful in dealing with large student/faculty ratios? A wide variety of complex activities are made available to the students. They have four hours of small group discusssion or laboratory, one hour of lecture, and five daily reading assignments each week. In addition they write four laboratory reports per term and have a wide variety of remedial opportunities for the reading quizzes, laboratories and laboratory reports. These educational experiences are provided for an average of one thousand students per term by a paid staff which is the equivalent of one half-time faculty member, one full-time graduate assistant, one full-time undergraduate assistant, and one full-time secretary.

A third problem faced by today's colleges and universities is the rising cost of education. Many fine institutions are in financial crisis. Yet the demand for their services are increasing. The crisis is largely a result of the high cost of personnel, equipment, and the physical plant. This trend may be reversed through careful planning and efficient use of these valuable commodities.

Two aspects of this solution to the cost of education have just been discussed. One is the evaluation of student performance by the students themselves, and the other is the provision of an adequate supporting staff of assistants and secretaries for the faculty. Along the same line, the students in the course are also obliged to perform 2 or 3 hours of work during the term to help with the management of the course. These activities include animal care, laboratory maintenance, and clerical work. This allows the faculty member to spend his time on activities requiring his advanced training and to delegate other activities to his staff, the teaching apprentices, and the students themselves.

Another problem is the scheduling of class so that the classrooms operate at capacity throughout the day. By having laboratory and discussion sections meeting from 8:00 a.m. to 9:00 p.m., an average of four thousand student-class hours per week are scheduled in two classrooms, totaling twelve hundred square feet of floor space. Extra laboratories are scheduled in the same space on Friday and Saturday. Make-up quizzes and lectures are scheduled elsewhere.

RELEVANT LIBERAL EDUCATION

Students often complain that the relevance of a liberal or general education to the affairs of the world is not sufficient to maintain their interest. Faculty members frequently confess that the goals of a liberal education are rarely achieved by education programs actually in existence. Furthermore, it is commonly stated that the attainment of a liberal education is incompatible with the attainment of a relevant or practical education. We believe that these two types of education may be achieved simultaneously and may in fact reinforce one another.

One of the problems of a curriculum aiming toward a liberal education is that no adequate framework has been developed to integrate the various traditional academic disciplines. A curriculum in behavioral science and technology, however, can illustrate the approaches of the various academic divisions and at the same time provide a framework for bringing them together.

By being sensitive to the interests of the students, an introductory course has been developed whose relevance and importance is generally obvious. Programmed texts are our primary means of teaching the principles of behavior; however nearly half of the reading assignments and nearly all of the lectures are devoted to emphasizing the relevance, utility, and importance of the principles of behavior. Little effort is made in this introductory course to teach the value of an abstract science; instead the role of the principles of behavior in the analysis and control of significant human behavior is emphasized. This has been greatly facilitated by the experimental material now available in behavior modification. No attempt is made in this first course to give an overview of all the various fields of psychology or the various approaches to be found in psychology. Nonetheless the general approaches and problems to be found in the natural sciences, social sciences,

and humanities are illustrated in this course.

DISCUSSION

Several features of this course may warrant additional comment:

Daily Reading Assignments and Quizzes

The rate at which quizzes over the reading assignments are given is determined by the instructor. In this sense they are "instructor paced." Such a procedure prevents the student from waiting until the end of the term when there will be insufficient time to study the material and then attempt to master the semester's reading - an all too frequent phenomenon when the reading is entirely "student paced." On the other hand the rate a student covers a specific assignment is determined by the student. In other words one student may need to spend only 15 minutes on the assignment whereas other students may need to spend 2 hours; the students may adjust their own personal daily work schedules accordingly. In this sense, it is "student paced." The individual differences in the rate of mastering the material may be accomodated within the instructor paced assignment and quiz system.

Peer Grading

The notion of peer grading is important. If we are to shape complex behavioral repetoires in students, it is probably necessary that the students emit responses from these repertoires and that these responses be differentially reinforced. In most cases it is necessary to have humans evaluate the quality of the responses. In mass education the tendency has been to use professors as evaluators. This presents a severe constraint on the amount of behavior of a given student that a professor may evaluate. As an alternative, machine evaluation of relatively simple behavior such as answering

multiple choice questions may be used. If a system can be devised whereby peer evaluation is used effectively, then it may be possible to shape complex behaviors in a mass educational setting. This is what we are attempting.

Doom's Day Contingency

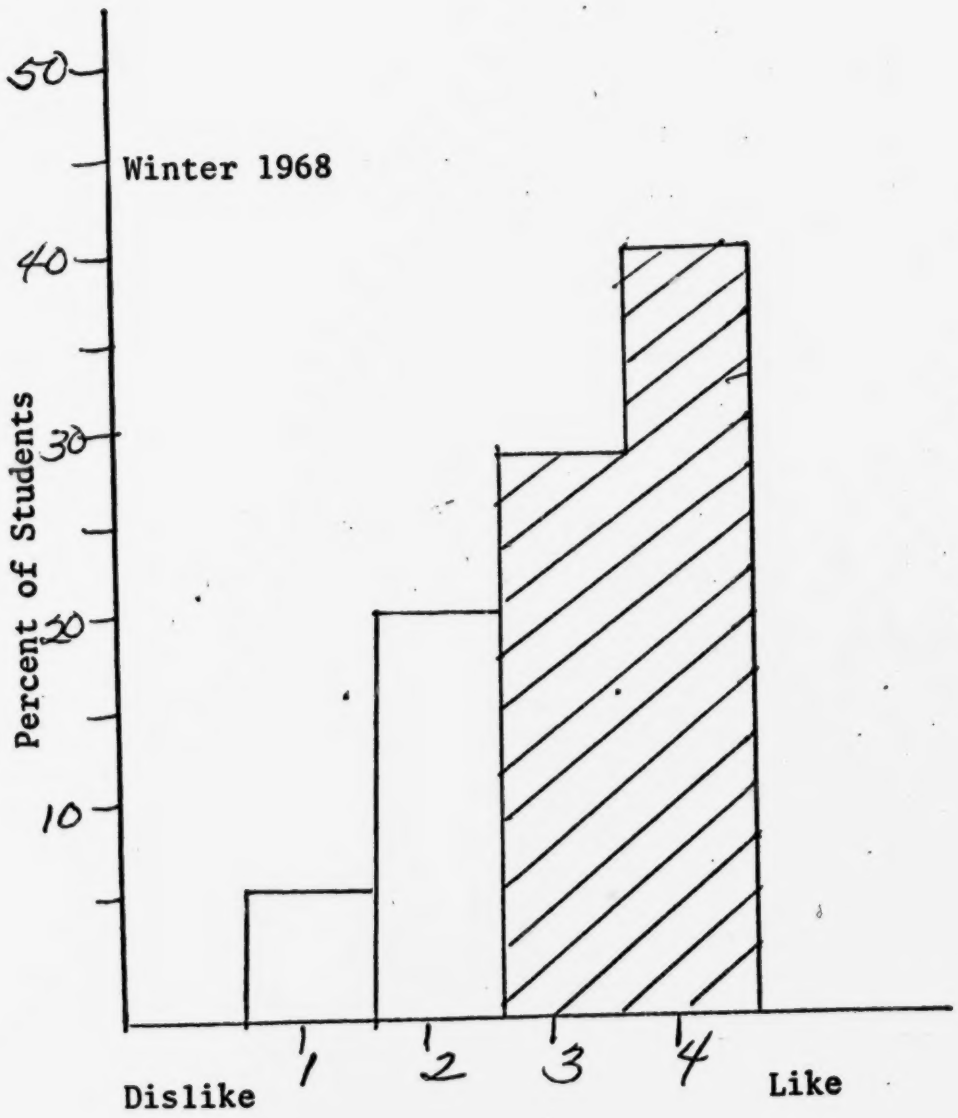
It was hoped that the Doom's Day Contingency was such that there would not be any undesirable side effects resulting from this use of aversive control. An analogous situation might be one in which an individual takes a pleasant stroll on the sidewalk adjoining a busy highway. There is a Doom's Day Contingency, ever present in that situation that is even more aversive than ours. If the individual indiscriminately steps into the highway, there is a high probability that he will be run over by the oncoming traffic. The fact that this Doom's Day Contingency is always there, does not greatly decrease the pleasantness or reinforcing quality of the stroll along the sidewalk since Doom's Day is so easily avoided. This also seems to be the case in our course.

Daily Quizzes

Although students obtain a high level of mastery of the material on a daily basis - "immediate recall," they do not do nearly as well on hour exams given at the end of the term covering this material - "long term recall." We have been constantly struggling with this problem. We wish to obtain a high level of mastery of all of the material covered during the entire semester even at the end of the term. Yet we wish to avoid the aversive side effects usually associated with final exams. We hope to be able to do this by giving occasional review quizzes which have the Doom's Day Contingency in effect. Reviewing for these quizzes should be greatly facilitated through the use of the list of reading objectives.

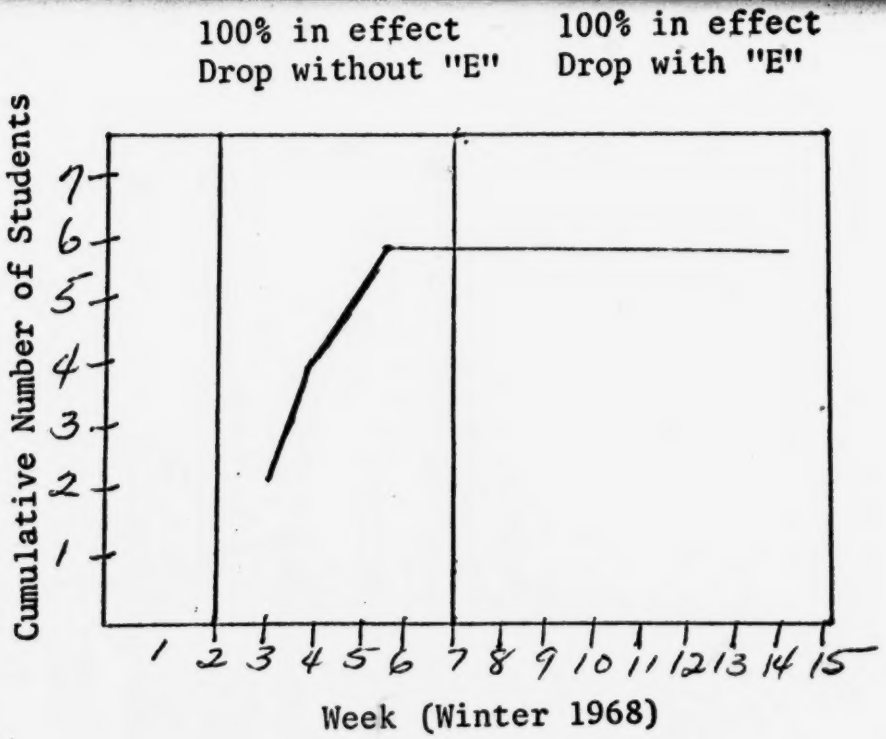
CONCLUSION

Solutions to the problems of student achievement have been proposed in terms of daily reading assignments and quizzes, clear specifications of the responses to be learned, opportunities for make-up work, one-hundred percent mastery required, error analysis, immediate feedback on quiz performance, procedure quizzes, and a strict absence policy. The problem of high student/faculty ratio have been dealt with in terms of peer grading, student teaching apprentices and student assistants. These factors, and efficent classroom scheduling, are also involved in dealing with the high cost of education. The common complaint that a liberal education is difficult to achieve and irrelevant to the world of affairs may be more readily handled in a course in behavior science.



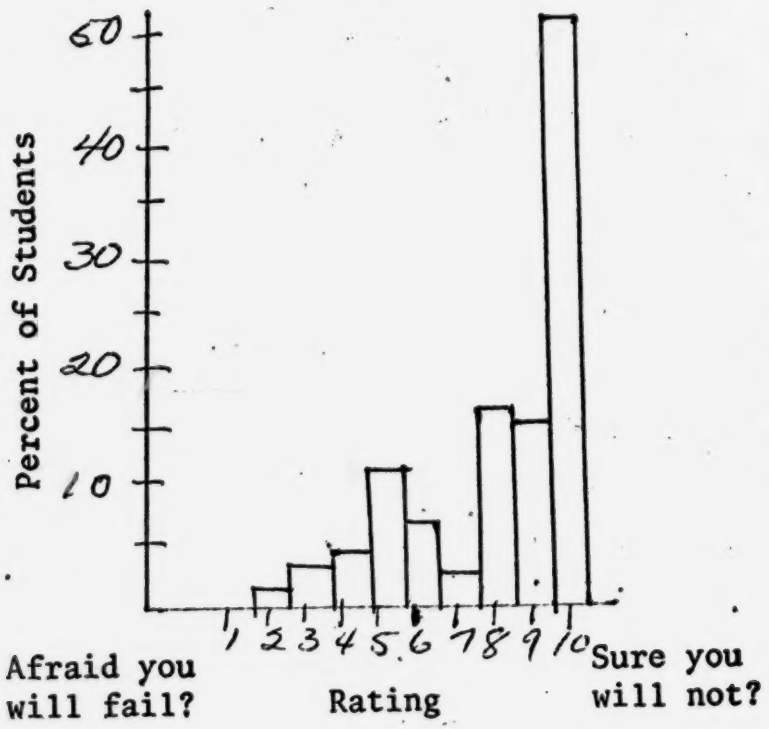
How do you feel about the daily quizzes?

Figure 1



Students dropping 150 for failure to meet 100%

Figure 2



In regard to the 100% mastery criterion

Figure 3